# Aerosol Photometer 2i

## Operation and Maintenance Manual

*P/N. 1800224, Revision E*
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# CHAPTER 1
# Introduction and Precautions

## Scope of Manual

These instructions cover the specifications, features, operation, maintenance, and troubleshooting for the 2i Photometer.

These instructions also contain important information required for the safe operation of the instrument. Before using this instrument, all personnel associated with the operation must read and understand this entire manual and become familiar with the terminology.

Failure to follow the specified procedures and precautions could result in **PERSONAL INJURY** or **DAMAGE** to the unit.

## Definitions

The following defines the warnings, cautions and notes used throughout this manual.

!

| Warning |
| --- |
| Indicates a strong possibility of severe personal injury or death if instructions are not followed. |

!

| Caution |
| --- |
| Indicates a possibility of equipment damage if instructions are not followed. |

¡

| Note |
| --- |
| Indicates that helpful information is provided. |

## Definiciones

Las siguientes anotaciones definen los peligros, cuidados y notas usadas a lo largo de este manual.

| Advertencia |
| --- |
| Indica una fuerte probabilidad de serias lesiones personales o muerte si no son seguidas las instrucciones. |

| Cautela |
| --- |
| Indica una posibilidad de daños al equipo si no son seguidas las instrucciones. |

| Nota |
| --- |
| Indica que se suministra información útil. |

## Définitions

Les informations suivantes, définissent les symboles, précautions et notes présentes dans ce manuel.

| Avertissement |
| --- |
| Indique la possibilité de dommages corporels graves pouvant entraîner la mort, si les instructions ne sont pas suivies. |

| Attention |
| --- |
| Indique la possibilité d’endommager l’équipement si les instructions ne sont pas suivies. |

| Note |
| --- |
| Indique que des informations utiles sont fournies. |

## Definitioner

Efterföljande text beträffande varningar, varsamhet och noteringar är genomgående för hela manualen.

| Varning |
| --- |
| Innebär att allvarlig personlig skada eller död kan inträffa om instruktionerna inte följs. |

| Varsamhet |
| --- |
| Innebär att skador på utrustning kan inträffa om instruktionerna inte följs. |

| Notera |
| --- |
| Innebär att användbar information ges. |

## 定义

下面定义了在这本说明书中所有的警告,小心,注意.

| 警告 |
| --- |
| 表示如果不按照指导操作.引起个人人身伤害甚至死亡的可能性很高. |

| 小心 |
| --- |
| 表示如果不按照指导操作.可能会损害仪器 |

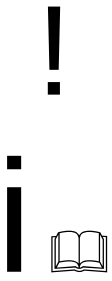
| 注意 |
| --- |
| 表示提供了有用的信息. |

## User Responsibility

The user must:

1. read and comprehend the information contained in this manual before using the product;
2. have an understanding of the electrical and mechanical system principles used in the operation of this photometer;
3. be trained in the proper use of electro-mechanical equipment;
4. properly use this product for the intended purpose and follow all regulations and procedures that apply to the location where this product is used;
5. maintain the product as specified in this manual;
6. maintain and keep in proper working condition any other equipment associated with the operation of this product.

## Precautions



### Warning – General Safety Rules

Read and understand all instructions. Failure to follow all instructions listed below may result in electric shock, fire or serious personal injury. The warnings, cautions, and instructions discussed in this operation and maintenance manual cannot cover all possible conditions and situations that may occur. It must be understood by the operator that common sense and caution are a factor which cannot be built into this equipment, but must be supplied by the operator.

### Caution – Shipping Hazard

When returning a 2i-N for service, the end user must remove the potentially contaminated sampling train prior to shipping the instrument. Refer to the 2i-N addendum for the proper procedure.

### Caution –Serviceability

There are no user-serviceable parts inside the instrument. Refer all repair and maintenance to a qualified factory-authorized technician.

## Caution - Maintenance

Incorrect fuse replacement may damage internal components of the photometer.

## Warning – Electrical Hazard

- Electrical hazard that can cause severe injury or death.
- The electrical housing contains multiple high voltage sources. Do not insert any objects under the cover

## Warning – Damaged Equipment

- Do not operate the equipment with a damaged cord or plug or after the equipment has malfunctioned, or been damaged in any way.
- Contact ATI Service Department for advice on examination, repair, electrical or mechanical adjustment.
- Failure to follow the prescribed procedures may result in a hazardous situation.

## For Customers in Canada

**Note – Regulatory Information**

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la Classe B est conforme à la norme NMB-003 du Canada.

## For Customers in the USA

**Declaration of Conformity**

| | |
|---|---|
| Trade Name: | ATI |
| Model Number: | 2i |
| Responsible Party: | Hamilton Associates Inc. |
| Address: | 11403 Cronridge Drive<br>Owings Mills, MD 21117<br>USA |
| Telephone No: | 410-363-9696 |

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## Note – Regulatory Information

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

# For Customers in Europe

**Declaration of Conformity**
Application of Council Directive(s): 2004/108/EC

Standard(s) to which conformity is declared:
EN 55011:2007; EN61000-3-2: 2005; EN61000-3-3:1995:A1 (2001):A2 (2005); EN 61326-1:2006

| | |
|---|---|
| Manufacturer's Name: | Air Techniques International |
| Manufacturer's Address: | 11403 Cronridge Drive<br>Owings Mills, MD 21117 |
| Type of Equipment: | Measurement Instrument |
| Model Number: | 2i Photometer |
| Year of Manufacture: | 2012 |

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Place: Air Techniques International

Signature: Eric A. Hanson

Full Name: Eric Hanson

Date: 23 Apr 2012

# For All Customers

**Disposal of Old Electrical & Electronic Equipment**

This symbol on the product and / or accompanying documents means that used electrical and electronic products should not be mixed with general household waste. For proper treatment, recovery and recycling, please take this product(s) to designated collection points where it will be accepted free of charge. This symbol is only valid in the European Union. If you wish to discard this product please contact your local authorities or dealer and ask for the correct method of disposal.

This product shall not be treated as household waste. Instead it shall be handed over to the applicable collection point for recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. The recycling of materials will help to conserve natural resources.

For more detailed information about recycling of this product, please contact your local Civic Office, your household waste disposal service or the Company where you purchased this equipment.

# CHAPTER 2
# Photometer Overview

## Instrument Description

The 2i is a forward light-scattering, linear digital photometer. It operates on 100 to 240 Volts, 50 or 60 Hz, adjusting automatically. Its most basic function is to sample air or other gases and report the mass concentration of particulates in the sample. The primary application for the 2i is integrity/leak testing of HEPA/ULPA filtration systems.

The 2i is a compact and lightweight instrument. The instrument case is constructed of rugged die cast aluminum. The pressure-sensitive keypad and large, bright LCD display and indicators provide ease of operation and readability. The auto-ranging and one-step zeroing features assure the accuracy of all readings.

Using the 2i is extremely intuitive through the use of a basic menu structure. Operation of the instrument is simple and straight forward. Use of the fully compatible *iProbe* affords full unit control from the scanning probe. The 2i provides easy access to real-time results via USB or optional printer, while remaining versatile enough to accommodate special testing needs that have become commonplace in today's filter testing industry.

When all of these elements come together as they have in the 2i, the testing process ceases to be a training intensive exercise and becomes a "set and forget" secondary routine performed as part of the daily work requirements in clean room testing.

## Filter Leak Testing: The Most Common Application

The most common application of the Aerosol Photometer 2i is to detect leaks in high efficiency filtration systems (HEPA & ULPA). To validate the integrity of a filtration system, a known challenge

agent consisting of an airborne test aerosol is generated and introduced upstream of the filter. The challenge agent provides particulate matter upstream of the filter to allow measurements downstream of the filter.

The test aerosol is introduced into the upstream side of the filter(s) as far from the filters as is practical to insure adequate mixing. Ideally, a distance of 10 duct diameters upstream is considered the minimum. A sample of the aerosol-air mixture should be taken from the upstream side, close to the center of the filter/filter bank. This sample is used to establish a 100% base line for the upstream concentration. The 2i is adjusted as described in the Operating Section to set the 100% reading and the stray light is adjusted automatically. The stray light adjustment compensates for light reflection off internal surfaces of the scattering chamber. After these adjustments have been made, the 2i instrument is ready to check for filter leaks/integrity downstream.

The filter test is performed with the use of the scanning probe. The filter and the perimeter of the filter pack should be scanned by passing the probe in slightly overlapping strokes so the entire area of the filter is sampled. The end of the probe should be held one inch from the filter surface. Separate passes should be made around the entire periphery of the filter, along the bond between the filter pack and the frame, and around the seal of the filter. Readings on the meter will indicate percent of penetration.

The display indicates the percent of leakage through or around the filter. The *iProbe* is supplied with the industry standard rectangular, blue isokinetic nozzle. This nozzle is used for fast scanning and is accepted by many standards, including NSF 49-2002.

Other optional probes are available, a round, black 1 inch (25 mm) in diameter nozzle, which complies with NSF (National Sanitation Foundation) Standard 49-1992, and a round, red nozzle. The isokinetic nozzles are designed for face velocities of 90 +/- 20 feet per minute (fpm) when using a 1 cfm (28.3 L/min) sample rate.

# How the Photometer Operates

## Theory of Operation

When air or gas is drawn through the instrument, particulate matter in the sample passes through the focal point of the scattering chamber. Particulate matter scatters light into the dark cone and onto the photomultiplier tube, which converts the light into an electrical signal. The signal is amplified and digitized, then analyzed by a microprocessor to determine the intensity of the light scattered by the signal. This signal is then compared to a reference signal to provide an output that is normalized by the reference signal.

A photometer is ideally suited to detect particulate matter in air or gas, reporting the mass concentrations encountered on a display. Particles from less than 0.1 micron to approximately 600 microns can be detected by the 2i. Since the photometer reports concentration of particulate matter, many applications are possible. By using a baseline of 100 micrograms per liter of aerosol, it is possible to directly read the concentrations of aerosols.

## Sampling System

A vacuum pump in conjunction with a flow meter, onboard sensors and closed feedback loop provides a constant volumetric sample flow rate of 1 cfm (28.3 liters per minute). The 2i uses an oil-free, dual head, diaphragm pump with a direct-coupled DC motor.

Solenoid actuated valving directs the airflow through the sampling system to the scattering chamber from three possible sources. The **CLEAR** position directs clean air from an internal ULPA filter to the scattering chamber for zeroing the instrument. The **UPSTREAM** position permits sampling of the air above the filter being challenged, and the **DOWNSTREAM** position permits sampling of the air that penetrates the filter.

## Light Scattering Chamber (LSC)

The scattering chamber is not only an integral part of the sampling system; it is a major component in itself.

The scattering chamber is a complex electro-optical unit that consists of a pair of hollow cones connected at the apexes. A pair of collimating lenses first straightens the light emerging from the light source, and then focuses it at the center of the sampling cone. An aperture forms a dark cone around the photomultiplier, preventing light from arriving directly on the photomultiplier. A condensing lens opposite the LED source focuses light scattered into this dark cone onto the photomultiplier tube.

## Capabilities

The Aerosol Photometer 2i will measure percentage leakage or absolute aerosol concentration.

**Note**

Before attempting to operate this unit, become familiar with the features and functions.

## Input / Output features

**Alarms:**
The 2i, when used in conjunction with the *iProbe*, provides the user three sensory alarms: audible, visual, and vibratory. When a reading exceeds the user selected alarm point the display will turn red, a tone will sound, and the *iProbe* will vibrate, if enabled.

**Data Output:**
Leakage data is sent out the unit's USB port. This data can be logged with contemporary data acquisition software in real-time. Multiple types of data formatting are available to satisfy a wide range of applications (see "Reporting Modes" page 34 for more details). Data can also be printed to hard copy using the optional printer accessory when using the summary mode.

# Utility Requirements

**Power**

The 2i is equipped with a “Universal AC” power supply capable of handling 100 to 240 VAC, 50 to 60 Hz. A line power conditioner and surge protector is recommended.

**Ambient Air Conditions**
While the instrument was design to be operated through a wide range of environmental condition, we recommend its use in a controlled environment where the temperature is between 1°C and 45°C (34°F to 120°F Fahrenheit) and the relative humidity is between 20% and 95% non-condensing.

| Note |
| --- |
| A dedicated power line is recommended for stable machine operation. |

# CHAPTER 3
# Unpacking and Setting Up the Photometer

## Packing List

The 2i ships complete, ready to install and operate. Any additional accessories purchased on the same order will be listed as separate line items on the shipment packing list. Please confirm receipt of all line items prior to commissioning of the instrument.

Shipping with the standard 2i will be the following. Individual items may be packaged separately or installed:

- ❑ Sturdy Pelican Shipping instrument case
- ❑ "Operation and Maintenance" Manual
- ❑ Calibration Report
- ❑ *iProbe* Scanning Probe with umbilical
- ❑ 12 feet of clear sampling tube
- ❑ One set of spare o-rings and lint screen
- ❑ Power Cord (NEMA 5-15 125V or CEE 7/4 "Schuko" 250V configuration)
- ❑ NSF 49:2002 Isokinetic rectangular nozzle

## Unpacking

Wherever possible, packing materials should be retained for storage or future shipment and transportation needs.

After unpacking, if anything is missing or appears to be damaged, contact ATI Customer Service immediately at (410) 363-9696 (see "Contacting ATI" page 66).

## Installation

**Warning**

If the unit is used in a manner not specified within the user's manual, the protection offered by the equipment may be impaired.

## Before you begin

You will need the following items to set up the Aerosol Photometer Model 2i

- ❑ Electrical outlet (110 VAC or 220 VAC)
- ❑ 2i Scanning Probe or PVC Sampling Tube
- ❑ 1°C to 45°C ambient temperature
- ❑ Less than 95% RH, non-condensing.

**Note**

High ambient temperatures may create instability in the readings.

## Connecting Electrical Power

Voltage and current requirements for the Aerosol Photometer Model 2i are:

- ❑ 100 to 240 VAC, 2 amps

The Aerosol Photometer automatically adjusts to operate at the correct AC voltage for the destination country (given this voltage is within the specifications described in "APPENDIX D Specifications page 70). This voltage is noted on a label attached to the back panel of the instrument. The power cord contains a plug which is specifically adapted to the destination country.

You are responsible for plugging the power cord into a matching receptacle. To connect the Aerosol Photometer to electrical power, do the following:

1. Check to make sure the Aerosol Photometer is turned off. (Refer to Figure 2: Rear Panel Overview, for the location of the power switch.)

2. Plug the power cord into a matching power outlet.

**Warning**

Before connecting the power cord to the power outlet, make sure the cord has not been cut or otherwise damaged during shipment.

**Caution**

To prevent damage to the Aerosol Photometer, make sure the voltage listed on the back panel matches the power outlet where you plug it in.

## Connecting the Scanning Probe

If using the Aerosol Photometer 2i with the Scanning Probe, you should first connect the *iProbe* to the umbilical. To do so, connect the umbilical's electrical connector to the 7-pin connector on the end of the probe. Connect the aerosol sampling line quick-connect fitting to the quick-connect connector on the butt of the probe (see "Scanning Probe Overview" page 28 for the probe description).

**Note**

The two pneumatic quick-connect fittings are different; the smaller one must be connected to the *iProbe*, while the bigger one must be connected to the 2i base.

Once the umbilical is connected to the scanning probe, connect the other end to the main unit. Connect the umbilical's electrical connector to the 7-pin connector on the front panel of the 2i. Connect the aerosol sampling line quick-connect fitting to the quick-connect port of the photometer marked "DOWNSTREAM" (see "Front Panel General Overview" page 26 for the front panel component description).

**Note**

Always check the lint screen in both sampling ports before using the instrument (see "Maintaining the Photometer" page 61 for the procedure).

**Note**

When using the *iProbe* with the 2i, the probe should be connected to the photometer before the power is turned on. Otherwise the *iProbe* display will show the following message until the main unit has reached the running mode:

*"Waiting for User to complete current Base operation"*

# Connecting the Interface Ports

The 2i comes equipped with two standard Interface Ports: a USB port and a printer port.

## USB Port

The USB port is intended to interface with a computer to provide serial data acquisition capability. The port connection requirements are described in the following table.

**Table 1: Serial Port Settings**

| Setting | Value |
|---|---|
| Transfer Speed | 9600 |
| Data Bits | 8 |
| Stop Bits | 1 |
| Parity Control | N |
| Flow Control | None |

## Printer Port

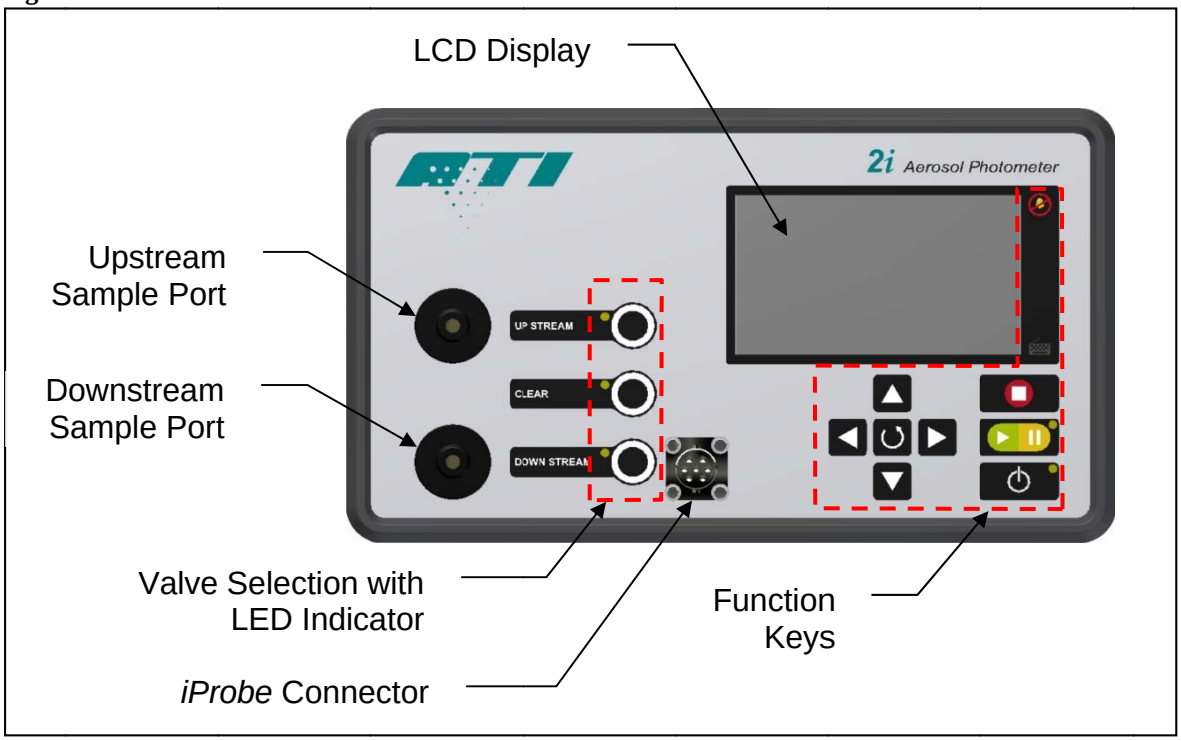
A 5-pin mini-din circular connector provides the interface with the optional thermal printer. The connector is keyed to prevent connection mistakes. To connect, orient the arrow toward the top and insert the connector in the receptacle.

| Note – Port Usage |
| --- |
| Do not use the Printer Port with equipment other than those designed and supplied by ATI. Damage to the equipment might result from such action |

# CHAPTER 4
# Know Your Equipment

## Front Panel General Overview

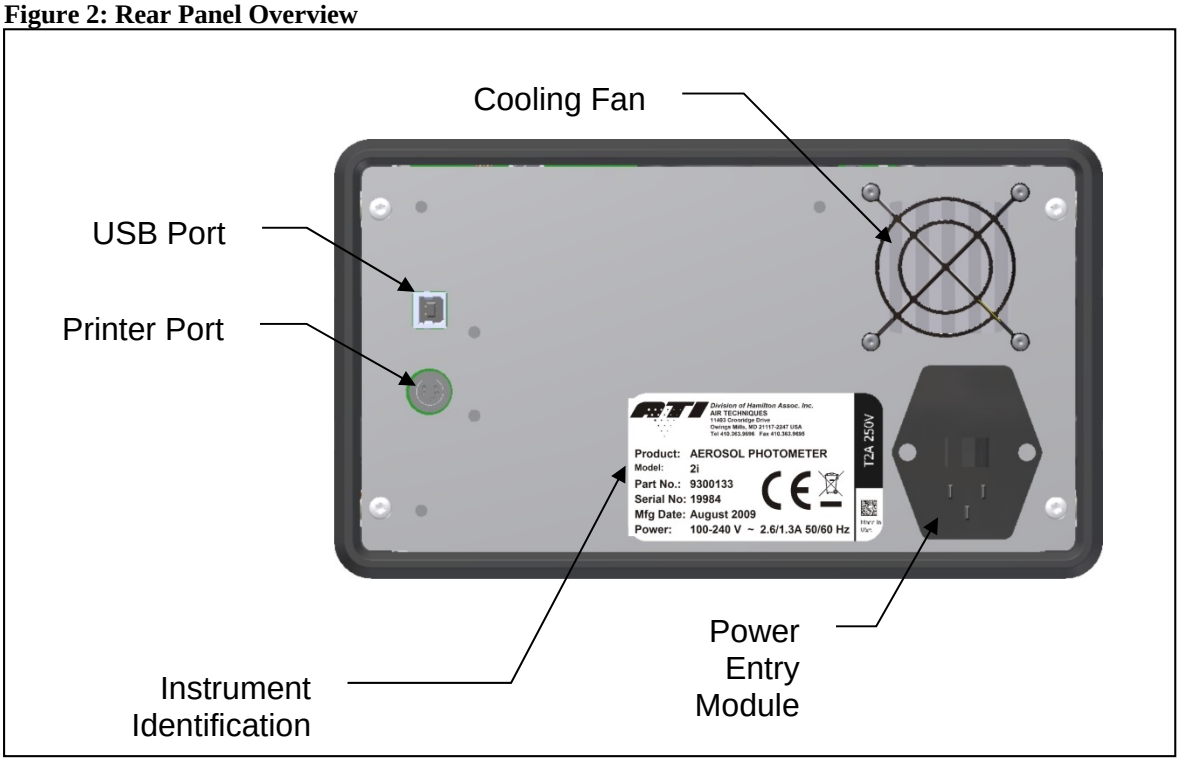
**Figure 1: Front Panel Overview**




| Description | Function |
|---|---|
| LCD Display | The color LCD display is the primary interface with the 2i. During operation, percent leakage readings are displayed as well as icons informing the user of the selection and status of alarms, selections and connected peripherals. |
| Function Keys | The function keys are used to access the settings and operating parameters with the menu structure. |
| Valve Selection with LED Indicator | Pressing one of the buttons will select the port as the source of aerosol and a blue LED will indicate the selection. |
| Upstream Sample Port | Connects to the sample tubing that is used to measure the upstream aerosol concentration. |
| Downstream Sample Port | Connects to the sample tubing that is used to measure the downstream aerosol concentration. |
| *iProbe* Connector | A 7-pin circular connector with bayonet lock provides the electrical connection for the scanning probe. |

# Rear Panel General Overview

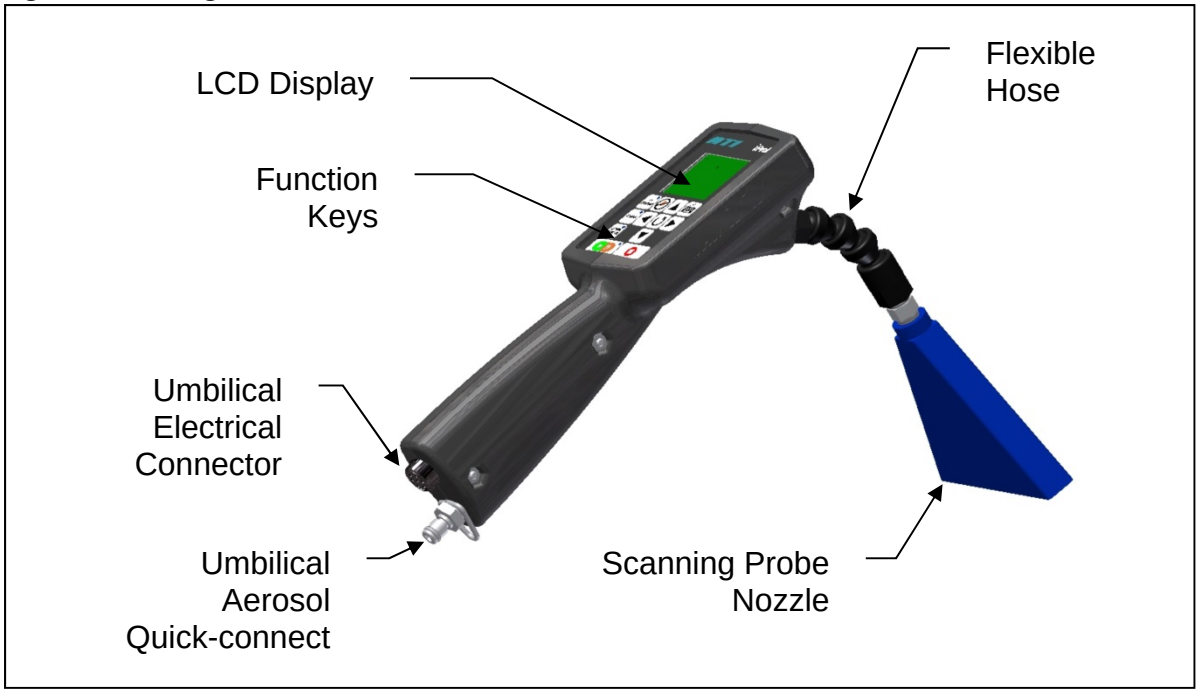
**Figure 2: Rear Panel Overview**




| Description | Function |
|---|---|
| Printer Port | Connection port for the optional thermal printer. |
| USB Port | Connection port to interface with a computer or data acquisition system. |
| Power Entry Module | Connects the instrument to the wall outlet. It also contains the fuses. |
| Instrument Identification | Provides the operator with useful information regarding the 2i, such as serial number and power ratings. |
| Cooling Fan | Provides temperature management inside the instrument enclosure. |

# Scanning Probe Overview

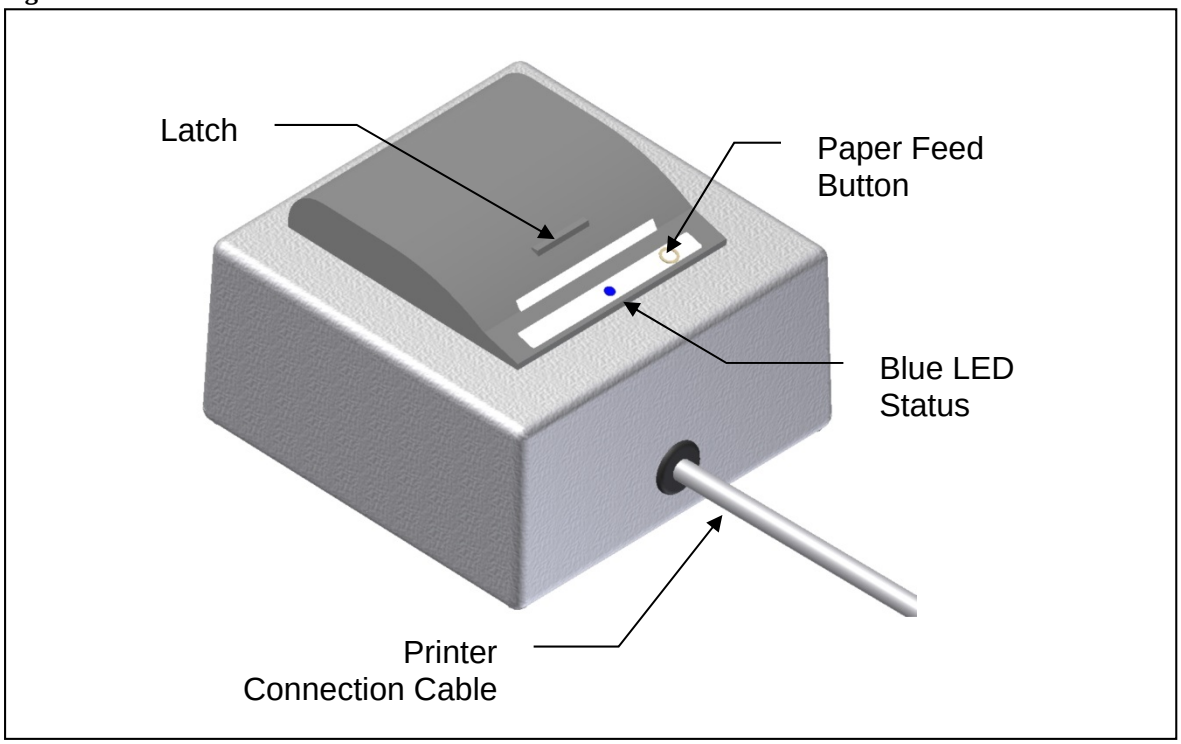
**Figure 3: Scanning Probe Overview**




| Description | Function |
|---|---|
| LCD Screen | The color LCD display is the primary interface with the *iProbe*. During operation, percent leakage readings are displayed as well as icons informing the user of the selection and status of alarms, selections and connected peripherals. |
| Flexible Hose | The flexible hose allows the operator to orient the scanning probe nozzle at various angles. It facilitates filter scanning and provides for a more ergonomic position. |
| Function Keys | The function keys are used to access the settings and operating parameters with the menu structure. They also allow the user to change the sampling valve selection. |
| Umbilical Electrical Connector | A 7-pin circular connector with bayonet lock provides the electrical connection for the scanning probe umbilical. |
| Umbilical Aerosol Quick-connect | Connects to the scanning probe umbilical aerosol sampling tube. |
| Scanning Probe Nozzle | This nozzle complies with NSF 49:2002 for isokinetic sampling. Legacy ATI nozzles are compatible with the *iProbe*. |

# Thermal Printer Overview

**Figure 4: Thermal Printer Overview**



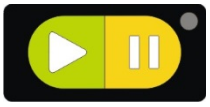

| Description | Function |
|---|---|
| Latch | Pulling on the latch will unlock and open the cover to allow changing the paper roll. |
| Paper Feed Button | Pressing this button feeds blank paper from the roll. |
| Blue LED Status | Indicate the status of the printer. See “Troubleshooting Guide” page 64 for more information. |
| Printer Connection Cable | Connects the printer the 2i base unit. |

# Function Keys

The function keys on the *iProbe* are identical to those of the 2i front panel. The *iProbe,* however, does not have a power button.

| Power Button |
| --- |
| To turn the instrument ON and OFF. |

| Arrow Pad Buttons |
| --- |
| To navigate the menus, change values and validate choices. The center button is the enter key. |



| Play / Pause Button |
| --- |
| To start the summary or monitoring reporting functions as well as pause them. |

| Stop Button |
| --- |
| To stop the summary or monitoring reporting functions. |

| Mute Button |
| --- |
| To mute the audible and vibratory alarms. |

| Keyboard Button |
| --- |
| To call the keyboard to the screen for entering a scanning location. |

# Sampling Ports

The sampling ports connect the instrument to either the scanning probe or 12 feet of clear tubing. They are quick-connect type connectors and are removable.

Each port contains a lint trap that should be cleaned periodically to prevent clogging (see “Maintaining the Photometer” page 61 for the procedure).

# CHAPTER 5
# Operating the 2i: Basic Operation

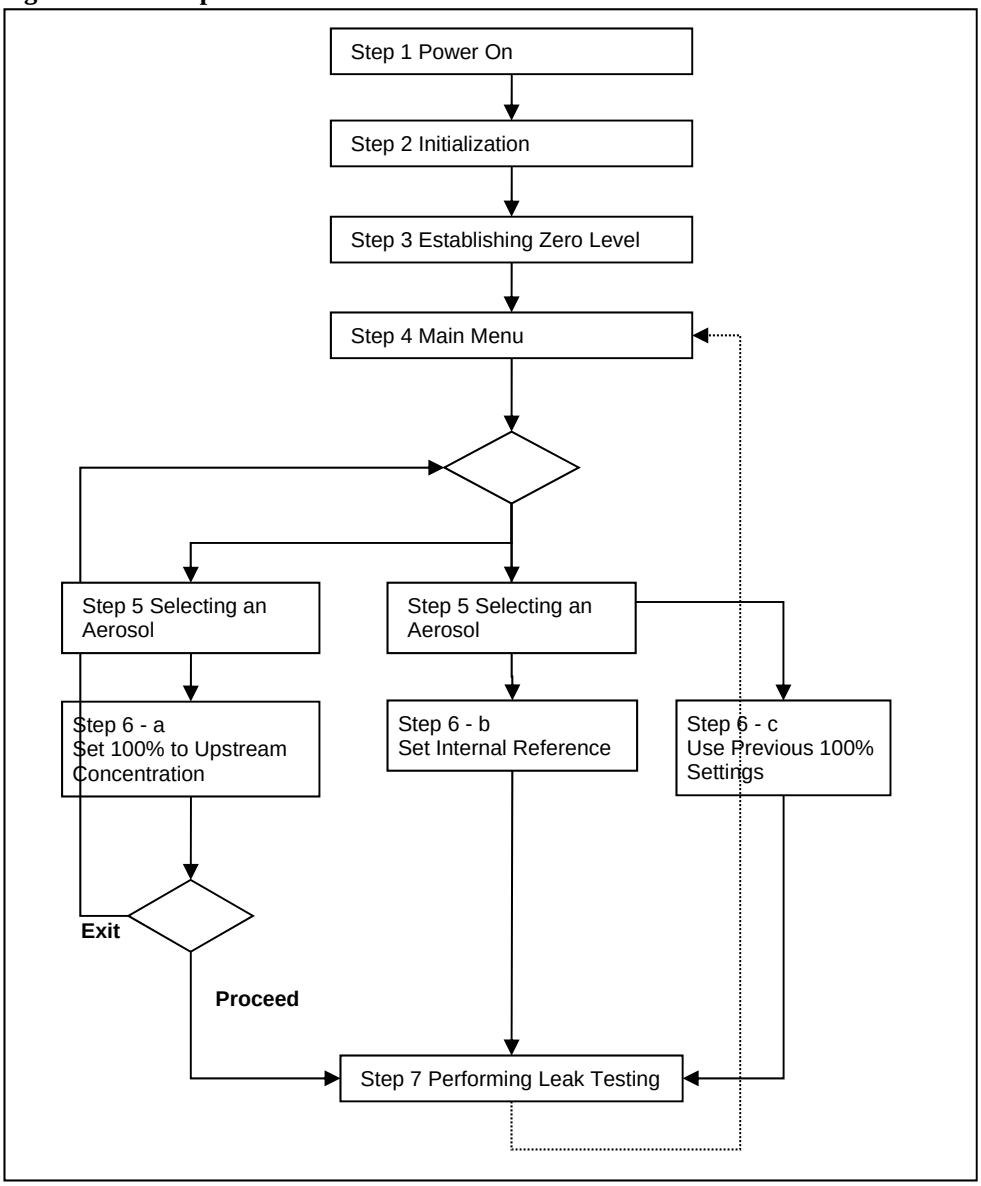
## Before You Begin

1) Attach the supplied power cord and connect to an appropriately rated electrical outlet. 110V @ 10 amps or 220V @ 5 amps.
2) Check the cleanliness of the upstream and downstream port lint traps. They should be free of fibers and debris.
3) Connect the *iProbe* electrical connector and sampling line to the main unit if desired.
4) Connect the printer accessory or data acquisition system if desired.
5) Enable operational power by switching the power entry module to the 'ON' position.

| Note – User Manual |
| --- |
| Make sure that the operator has been properly trained to use the instrument. At a minimum, he should have read this User Manual. |

# Basic Operation

**Figure 5: Basic Operation of the 2i Aerosol Photometer**




It is recommended that all routines be completed in the order they appear above to ensure reliable unit operation. Completion of these routines will provide a daily confirmation of the operational state of the photometer.

**Step 1 Power On**

Press the power button located at the lower right of the front panel.

**Step 2 Initialization**

When the unit is powered on, it undergoes an initialization cycle during in which it polls the system for available sensors and verifies communication with those sensors. The instrument will also regulate the sample line flow and once it reaches 28.3 ALPM the initialization phase is complete.

**Note**

Other information available on the screen is the unit serial number, software revision, machine identification number and the total operating hours. See "Software Description" page 41 for details.

**Step 3 Establishing Zero Level**

After initializing, the unit will automatically proceed with establishing the zero level. This process takes approximately 10 seconds. If it cannot establish a zero, the operator will be prompted to retry up to three times. The operator should press the **Yes** button to retry or the **No** button to shutdown the instrument. The operator will have to press the **Ok** button to shutdown the instrument if the zero level cannot be established at the last attempt.

**Step 4 Main Menu**

Once the zero level is established, the instrument will display the main menu. The operator can then choose to change parameters, such as the reporting function, date and time, or the alarm settings. He must then decide the method he wants to use to set the 100% reference for the instrument.

**Step 5 Selecting an Aerosol**

Before proceeding with setting up the 100% it is good practice to verify that the correct reagent is selected.

**Note**

The instrument saves the last reagent selected in memory even after a power cycle.

### Step 6 Choosing a Setup Method

**a Set 100% to Upstream Concentration**

The instrument will attempt to establish its reference baseline to the aerosol introduced in the upstream aerosol port. If it is successful, an estimate of the aerosol concentration and stability will be communicated to the user.

**b Set Internal Reference**

The instrument will set its reference baseline and internal gain based upon settings stored during factory calibration.

**c Use Previous 100% Settings**

The instrument will reset its reference and internal gain setup to the prior settings.

After successfully setting up the 100% reference, the instrument will automatically display the running mode screen and set the sampling valve to the downstream aerosol port.

### Step 7 Performing Leak Testing

The unit is now ready to perform leak testing or aerosol monitoring. To return to the main menu select the Home Menu key and press the **Enter** button (see “CHAPTER 6 Software Reference” page 41 for a full software description).

**Note**

If there is a concern that the zero baseline may have drifted, the operator may re-zero the instrument at any time by accessing the option in the main menu.

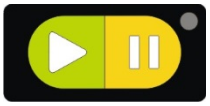
# Reporting Modes

## Summary Mode

The summary reporting mode was implemented with certifiers doing in-situ validation of high efficiency filtration systems (HEPA & ULPA) in mind. It provides

a summary of each filter tested on the USB port and, if connected, on the optional thermal printer. This feature is similar to that of a particle counter.

When this reporting mode is selected, the operator has the opportunity to enter a location for the testing he is about to perform by pressing the **keyboard** function key. This field is automatically reset at the end of the test to avoid unintended duplication of locations and should be repopulated prior to subsequent testing.



To start the reporting, the operator should press the **play/pause** function key. The header will be sent out to the ports and the acquisition of data sets will be initiated. The button LED lights up green and the data transmit icon is displayed (). A data set is sent every time the operator presses the **play/pause** function key to pause the test or at the conclusion of the test. When the test is paused, the play/pause button LED lights up yellow and the data transmit icon changes to indicate the new status (). The maximum penetration value is reset when the operator presses the **play/pause** button to resume the test, allowing the report to show all leaks present during the filter scan.

| Note |
| --- |
| If the probe is disconnected when the instrument is in play or pause, it will not synchronize with the base until the stop button is pressed. |

| Note |
| --- |
| If a leak is detected while scanning, the operator should press the play/pause function key to pause the reporting and acquisition of data while he fixes the leak. Pressing the play/pause function key will also stop the effective scanning time until it is pressed again. |

When the operator has concluded the testing, he must press the **stop** function key to end the reporting. When the key is pressed, the footer is sent out to the ports and the reporting is terminated.

A ticket consists of the following:

**Table 2: Summary Reporting Mode Ticket**

| |
|---|
| Header |
| Photometer Model |
| Unit Serial # |
| Calibration Due Date |
| Date |
| Field Separator |
| Location or Filter ID |
| Setup |
| Reagent |
| Actual Concentration |
| Upstream Value |
| Scanning Start Time |
| Field Separator |
| Data Set |
| % Leakage Alarm Value |
| Exceeded Alarm Value |
| Max % Leakage Value |
| Field Separator |
| Footer |
| End Time |
| Effective Scanning Time |
| Text Block |

**Note**

If the operator powers off the instrument while a test is in progress or an error is generated by the instrument, the message “Test Interrupted” will be sent to the USB and printer ports.

**Figure 6: Sample Summary Mode Reporting Ticket**

```
ATI Photometer 2i
Serial #: 123456
Cal Due: 1 May 2013
Date: 1 May 2012
------------------
ID: FILTER 123
Setup: Internal Ref
Reagent: PAO
Actual Con.: -
Upstream Val: 100
Start Time: 12:00
------------------
Leakage Alarm: 0.010%
Alarm Exceeded: No
Max Pen.: 0.0004%
------------------
Leakage Alarm: 0.010%
Alarm Exceeded: Yes
Max Pen.: 0.0403%
------------------
Leakage Alarm: 0.010%
Alarm Exceeded: Yes
Max Pen.: 0.0706%
------------------
End Time: 12:19
Scan Time: 3 Min 24 sec
Operator:
```

## Monitoring

The monitoring mode reporting function is similar to the summary mode reporting function. It differs in the content and format of the data set and footer. In this mode the data is only available on the USB port. The data set is described in the following table.

**Note**

In Monitoring mode, the operator cannot pause the acquisition of data set.

**Table 3: Monitoring Reporting Mode Ticket**

| Header |
|---|
| Photometer Model |
| Unit Serial # |
| Calibration Due Date |
| Date |
| Field Separator |
| Location or Filter ID |
| Setup |
| Reference Used |
| Actual Concentration |
| Upstream Value |

| | | | |
|---|---|---|---|
| % Leakage Alarm | | | |
| Start Time | | | |
| Field Separator | | | |
| Data Set | | | |
| Time | Leakage Alarm | Alarm Exceeded | % Leakage Value |
| Footer | | | |
| Field Separator | | | |
| End Time | | | |
| Field Separator | | | |

**Figure 7: Sample Monitoring Mode Data Output**

```
ATI Photometer 2i
Serial #: 123456
Cal Due: 26 Feb 2013
Date: 29 Feb 2012
------------------
ID:
Setup: Internal Ref
Reagent: PAO
Actual Con.: -
Upstream Val: 100
Start Time: 09:19:00
------------------
Timestamp, Leakage Alarm, Alarm Exceeded, Maximum Penetration
4, 0.010%, No,0.0046%
8, 0.010%, No,0.0049%
12, 0.010%, No,0.0053%
16, 0.010%, No,0.0052%
20, 0.010%, No,0.0054%
24, 0.010%, No,0.0053%
28, 0.010%, No,0.0054%
32, 0.010%, No,0.0054%
36, 0.010%, No,0.0053%
40, 0.010%, No,0.0053%
44, 0.010%, No,0.0051%
48, 0.010%, No,0.0052%
------------------
End Time: 09:19:48
------------------
```

## Continuous

The continuous reporting mode will output one % leakage reading approximately every second to the USB port of the instrument. The data consists of the penetration value followed by a comma.

**Note**

The Continuous reporting mode provides a data output identical to the legacy equipment TDA-2G and TDA-2H. To use an existing data acquisition system with the 2i adjust the port settings as described in “Connecting the Interface Ports” page 24.

# Alarms Modes and Set Point

## Alarm Set Point

The alarm set point will trigger the selected alarms when the % leakage measured exceeds the set point.

The operator can change the set point by selecting the alarm set point option and pressing the **Enter** button.

**Note**

The Alarm Set Point option is not accessible while the instrument is setting up to the 100% Upstream Concentration, while navigating the main menu or once data acquisition has been started in summary or monitoring reporting modes.

## Alarm modes

There are three types of alarms available on the 2i: audible, visual and vibratory. The alarms will be set-off when the measured % leakage value exceeds the Alarm Set Point. The user can select which alarms are enabled from the Alarm menu. For a detailed description of the different alarms, see “CHAPTER 6 Software Reference” page 49. The operator can quickly mute the activated alarm by pressing the **Mute** button.

**Note**

The Mute function will disable the audible and vibratory alarms if they are enabled but will not affect the visual alarm if it is enabled. The alarms revert back to their original state when the **Mute** button is pressed again.

# Icons

The following table describes the different icons displayed on the 2i user interface.

**Table 4: Icons Description**

| Icon | Displayed when … |
|---|---|
| | The optional thermal printer is plug into the instrument. |
| | A computer is interfaced with the USB port. |
| | The Upstream Aerosol Noise Suppression (UANS) is selected. |
| | The Downstream Aerosol Noise Suppression (DANS) is selected. |
| | The Continuous reporting function is selected. |
| | The Monitoring reporting function is selected. |
| | The Summary reporting function is selected. |
| | The *iProbe* is connected. |
| | The mute function is enabled. |
| | The Audible alarm is enabled. |
| | The Audible alarm is disabled. |
| | The Vibratory alarm is enabled. |
| | The Vibratory alarm is disabled. |
| | The Visual alarm is enabled. |
| | The Visual alarm is disabled. |
| | The instrument is sending data to the USB and Printer port. |
| | The data transmission to the USB and Printer port is paused when in Summary reporting mode. |
| | Toggle the running mode and the main menu on the *iProbe*. |

# CHAPTER 6
# Software Reference

This section describes the software supplied with the 2i Aerosol Photometer. It includes the following sections:

- A general description of the 2i software and user interface hardware
- Instructions for making selections or typing entries
- An overview of the menus and options
- Detailed reviews of all the functions and screens
- A list of error messages

Refer to **CHAPTER 5, Operating the 2i: Basic Operation** for a description of the basic procedure to be followed to perform a filter test.

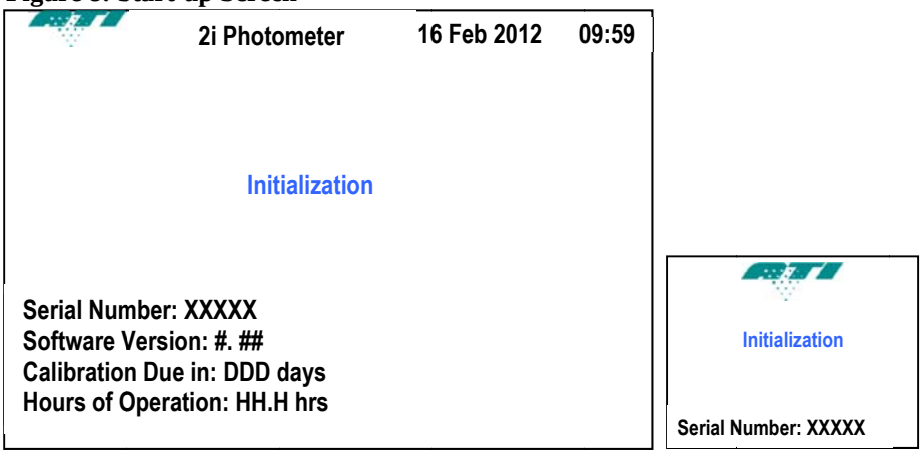
## Software Description

The software controls all aspects of instrument, including reading the forward light scattering photometer, pressure transducer, flow meter, temperature sensor as well as controlling the valve manifold and outputting test data.

### Start-up Screen

The software version as well as other useful information is displayed during the instrument initialization. The message block located in the bottom left corner of the screen is similar to the following:

**Figure 8: Start-up Screen**




"Serial Number" is your instrument unique identifier and is assigned during the manufacturing process.

"Software Version" will have a numeric character as the leading number followed by a decimal point and one or more numbers, representing the revision level (e.g., 1.2 or 1.23).

"Calibration Due in" indicates the number of days remaining until the manufacturer's recommended calibration for the instrument.

"Hours of Operation" indicates the amount of run time for the instrument since the last calibration.

# Making Entries

## Entering Numerical Values

After highlighting the desired option to modify, the operator should move the selection to the arrow representing his desired action. The arrow pointing up will increase the selected value while the arrow pointing down will decrease it. To change the value use the **Enter** button until the display indicates the desired value. To save the setting, move the cursor back to the highlighted selection and using the arrows select the **Save** option. Press the **Enter** button to validate the choice.

## Turning Options Flags On or Off

There are two types of flags in the 2i software. The first type is used to toggle an action (ON or OFF) or change the status of an option (enable/disable) while the second type is used to set the status of a flag from a list of possible choices.

The first type is a square box (also called check box) and is used to toggle an action ON or OFF. Changing the state is accomplished by selecting the square and pressing the **Enter** button. Depending on the context, the check box status might not be saved in memory and exiting the screen will reset it to its normal operating state. A checked square indicates a selection (or ON state,☑) while the empty square shows the option deselected (or OFF state,☐).

The second type of flag is a circle (also called radio button) and is used to enable (⊙) or disable (○) a flag and the resulting choice is stored in memory. When this option is present, only one of the radio buttons within the group can be selected by pressing the **Enter** button. It is used when multiple choices are available but only one choice can be made.

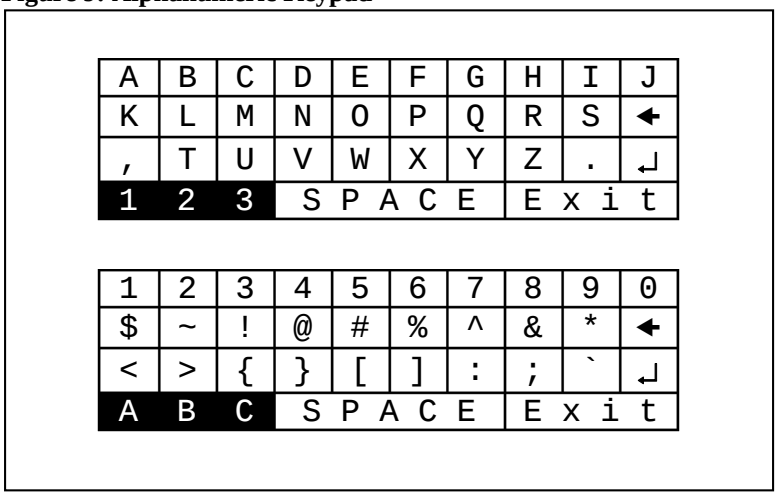
## Using the Alphanumerical Keypad

Prior to starting a test in summary or monitoring reporting mode, the operator can enter a filter/location ID using the integrated alphanumeric keypad. The operator must press the keypad function key to bring up the keypad on the screen.

Navigate to a character using the arrow keys and press **Enter** to select it. To toggle between the alpha and numerical keypads, select the “1 2 3” or the “A B C” selection and press **Enter**.

When the operator has finished entering his selection, he may select the enter key “↵” or the “Exit” key.

**Figure 9: Alphanumeric Keypad**

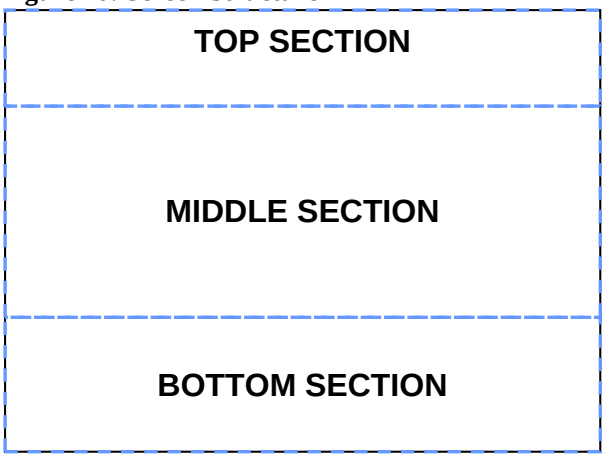



# General Screen Structure

The screen is generally divided in three sections:

- The top section of the screen provides the user with an indication of the date and time as well as an icon tray indicating the status of peripherals and some setup selections.
- The middle section contains the actual menu items or the penetration display.
- The bottom section contains quick access to the most commonly used functions.

**Figure 10: Screen Structure**

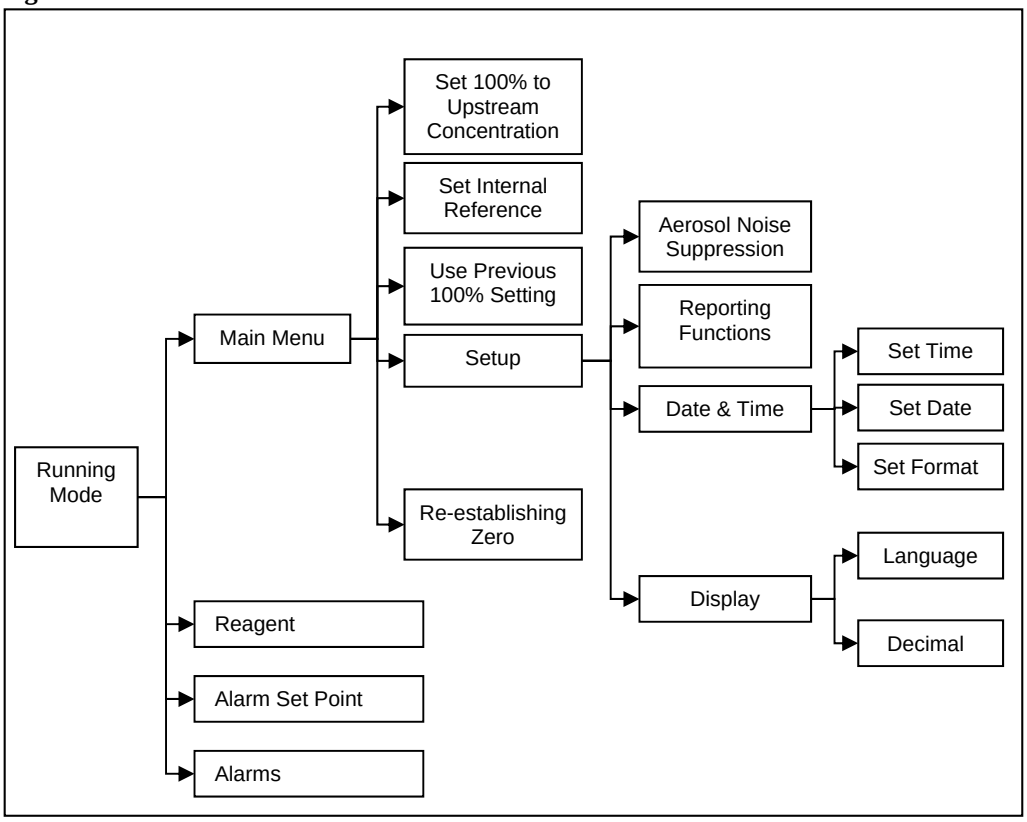


# Menu Structure and Options

## Menu Structure

The following figure gives an overview of the 2i menu structure. Menu depth has been limited to facilitate the navigation between the different options.

**Figure 11: Overview of the 2i Menu Structure**



## Run Mode Screen

**Figure 12: Running Mode Screenshot**

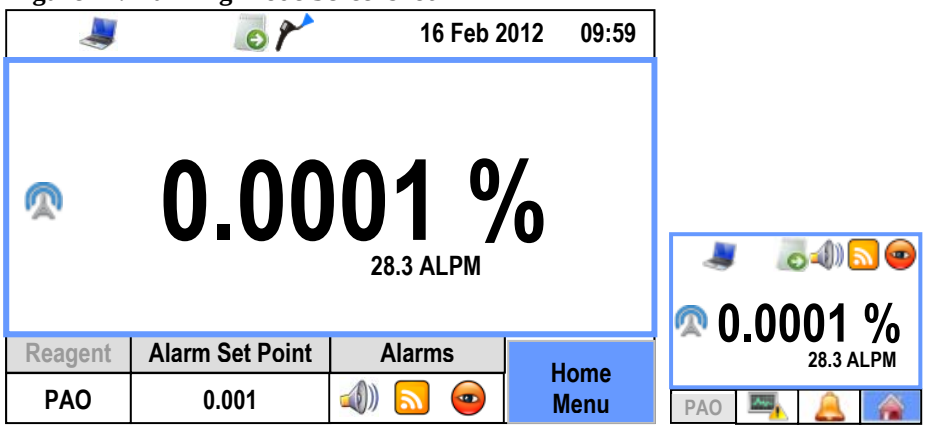



**Table 5: Running Mode Options**

| Description | Function |
|---|---|
| **Alarm Set Point** | Allows the operator to change the instrument alarm set point. |
| **Alarms** | Allows the operator to select which alarms are enabled. |
| **Sampling** | Allows the operator access to the Main Menu. |

## Top Level Menu Options

**Figure 13: Main Menu Screenshot**

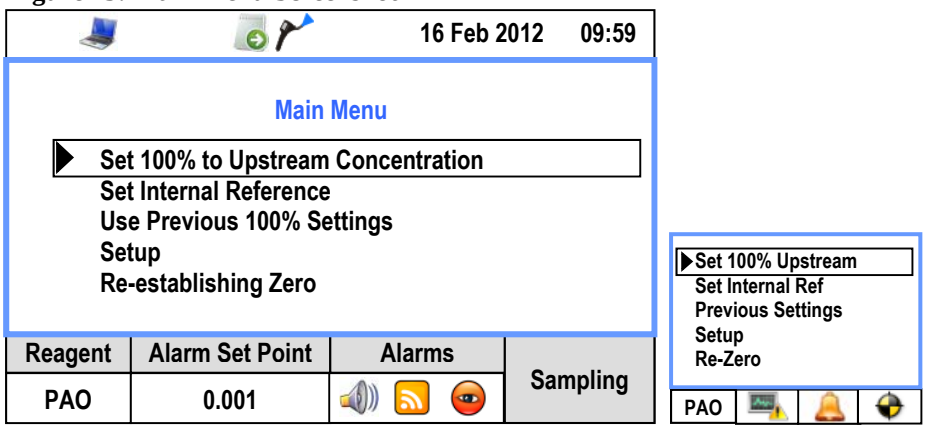



**Table 6: Main Menu Options**

| Description | Function |
|---|---|
| Set 100% to Upstream Concentration | . |
| Set Internal Reference | . |
| Use Previous 100% Settings | . |
| Setup | . |
| Re-establishing Zero | . |
| Reagent | |

# Alarm Set Point

Changing the alarm set point

**Figure 14: Setting the Alarm Set Point Screenshot**

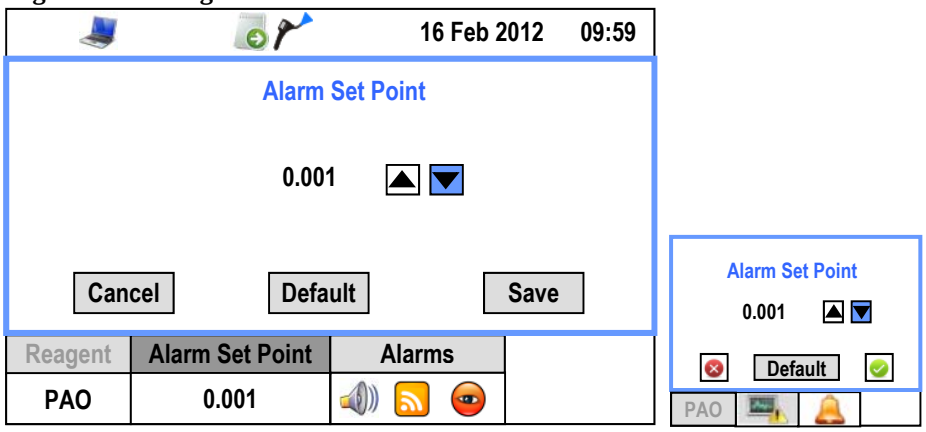



**Table 7: Alarm Set Point Options List**

| Parameter | Function | Icon | Limits |
|---|---|---|---|
| **Alarm Set Point** | Change the alarm threshold for % leakage. | N/A | 0.001 to 100 |

# Alarms

Changing the alarms selection

**Figure 15: Setting the Alarms Screenshot**

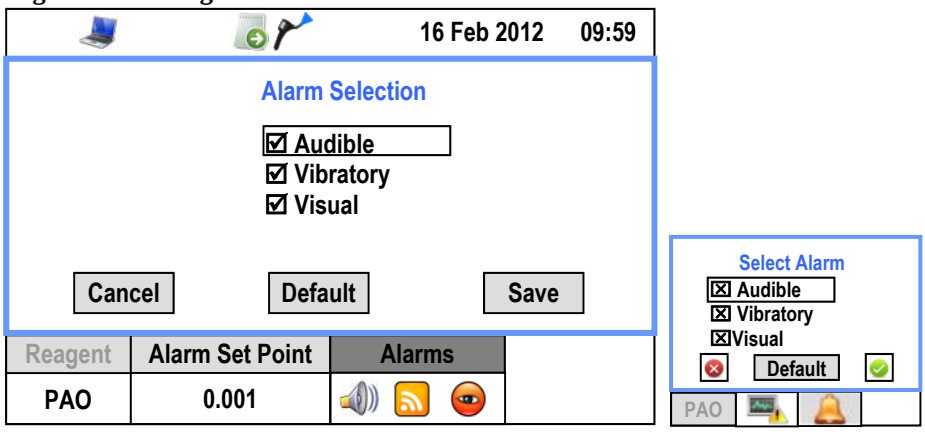



**Table 8: Alarm Selection Options List**

| Parameter | Function | Icon enabled | Icon disabled |
|---|---|---|---|
| **Audible** | Audible alarm on the base unit and the probe. | | |
| **Vibratory** | Vibratory alarm in the probe | | |
| **Visual** | Visual alarm on the screen of the base unit and the probe | | |

# Set 100% to Upstream Concentration

When selecting this method to setup the instrument, the user is guided through the process by a series of screen. This section describes the different screens.

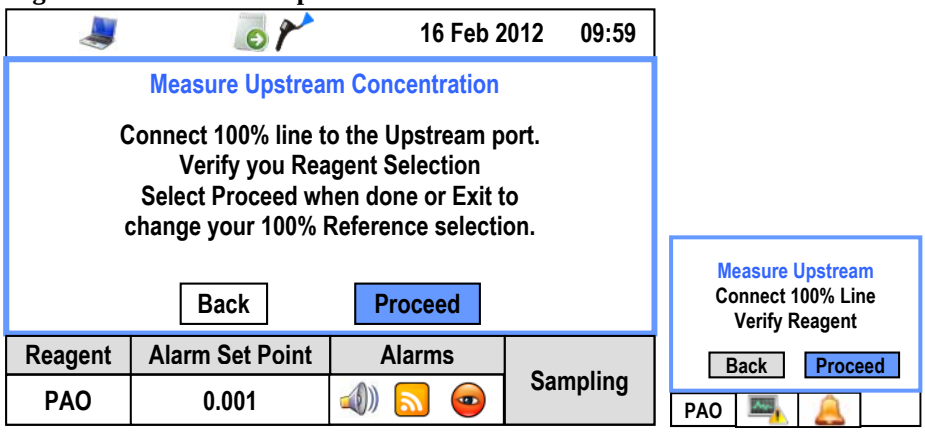
**Note**

It is unnecessary to change the internal reference value when setting the 100% upstream concentration. The internal reference is set to 100ug/L for the reagent in use for display on the LCD main screen. This method is different than the 2G nad 2H models.

## Instructions

This first screens instruct the user to verify the reagent selection as well as the aerosol line connection to the upstream port. To continue with setting up the instrument to the upstream aerosol, select **Proceed** and press **Enter**. To return to the main menu and change you selection, select **Back** button and press **Enter**.

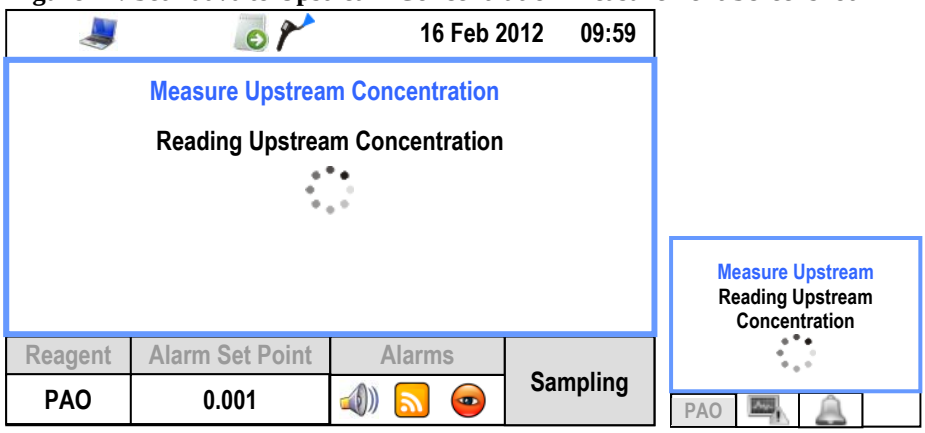
**Figure 16: Set 100% to Upstream Concentration Initial Screenshot**




## Measuring the Upstream Aerosol

After the operator selects **Proceed**, the instrument will attempt to set its 100% reference to the upstream aerosol. An animated icon will be displayed on the screen during this operation. During this operation, the reagent, alarm set point and alarms options are disabled.

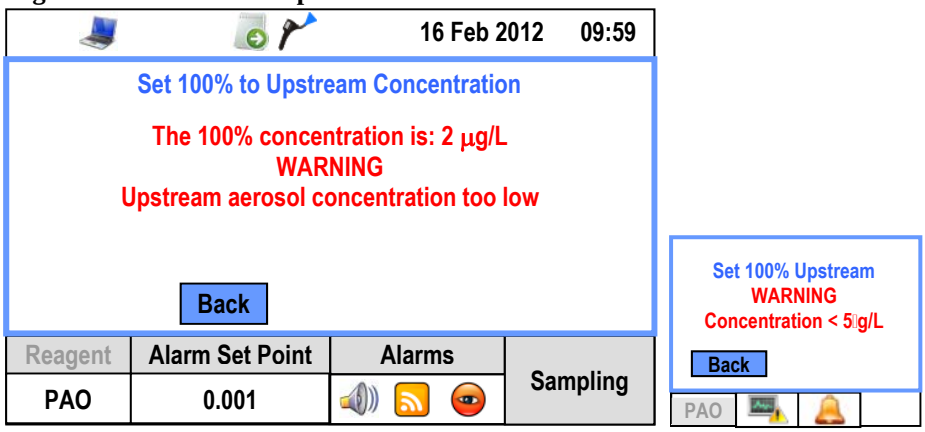
**Figure 17: Set 100% to Upstream Concentration Measurement Screenshot**



## Accepting the Result

Once the instrument has set its reference to the upstream aerosol, the calculated concentration will be displayed as well as an estimate of the aerosol stability.

**Figure 18: Set 100% to Upstream Concentration Final Screenshot**




# Set Internal Reference

Establishes the internal reference base response based upon a gain setting stored during factory calibration. When changing reagents be sure to re-zero the instrument.

**Figure 19: Set Internal Reference Screenshot**

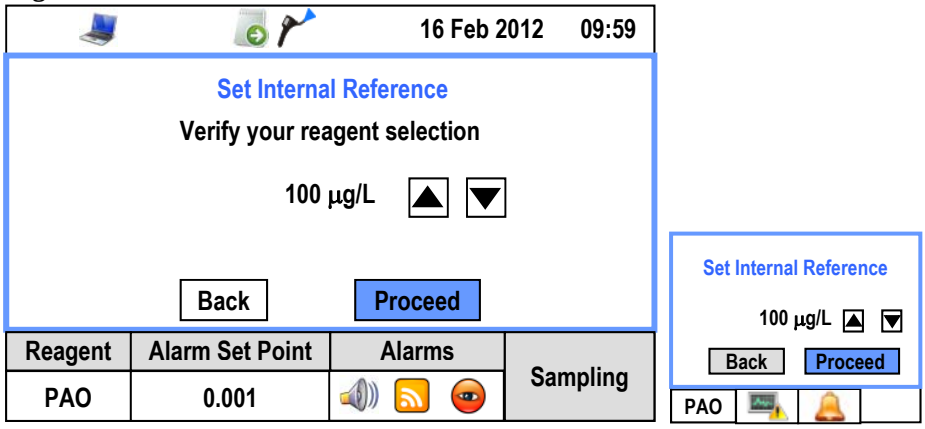



**Table 9: Internal Reference Set Point**

| Parameter | Function | Icon | Limits |
|---|---|---|---|
| **Internal Reference Set Point** | . | N/A | 5 to 120 Increment of 1 |

## Use Previous 100% Settings

When selecting this option, the instrument will reset to the previous 100% setting. It allows the operator to move the instrument to a different electrical outlet while minimizing the startup time.

**Note**

When using this function, make sure that your upstream aerosol challenge stays identical.

## Re-establish Zero

If there is a concern that the zero baseline may have drifted, the operator may re-zero the instrument at any time by selecting this option form the main menu.

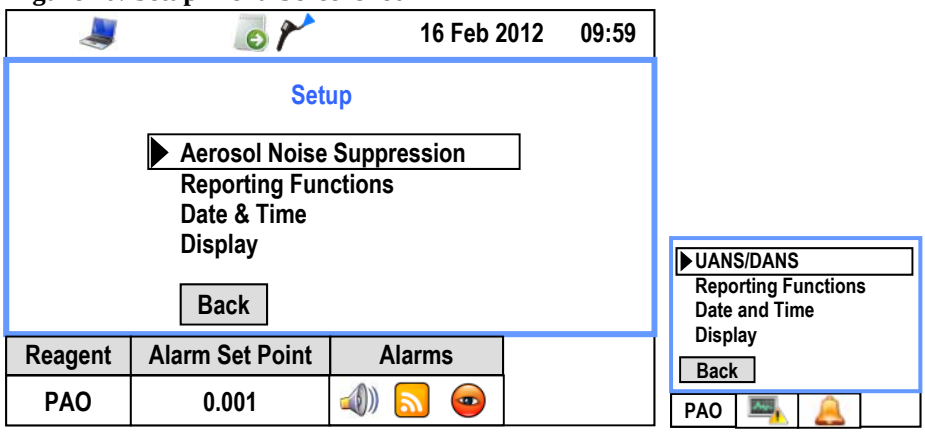
The highlighted selection will flash until the instrument has completed the re-zeroing process. Once the operation is complete the display will revert back to displaying the leakage value.

**Note**

When the instrument drifts too far from zero a warning will be displayed asking if the user would like to re-establish the zero.

# Setup

**Figure 20: Setup Menu Screenshot**




## Aerosol Noise Suppression

| Note |
| --- |
| The Downstream Aerosol Noise Suppression (DANS) is not available when the *iProbe* is connected to the instrument. This prevents the user from accidentally skewing results by suppressing actual readings in the downstream mode. |

**Upstream Aerosol Noise Suppression (UANS)**
The Upstream Aerosol Noise Suppression mode is selectable by the operator when using the upstream port during measurement, not while setting 100%. When poor upstream mixing makes the measurement of the upstream concentration difficult, the noise suppression should dampen these variations.

An icon indicates when UANS is ON. The default condition is ON.

**Downstream Aerosol Noise Suppression (DANS)**
The Downstream Aerosol Noise Suppression mode is selectable by the operator when performing non-scanning applications on each port. The DANS performs applies an averaging function on the data collected. It is not available when the probe is connected.

An icon indicates when DANS is ON. The default condition is OFF.

| Note |
| --- |
| When the operator connects the probe, the DANS function will automatically be disabled if it was previously selected. This will preserve the integrity of the test results while performing a filter scan. |

**Figure 21: Aerosol Noise Suppression Screenshot without Probe**

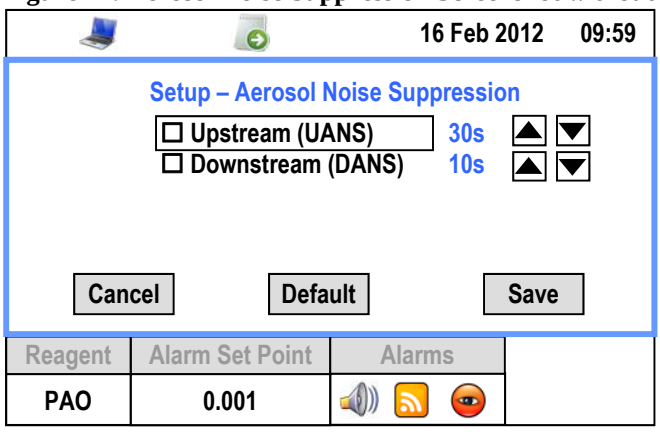



**Figure 22: Aerosol Noise Suppression Screenshot with Probe**

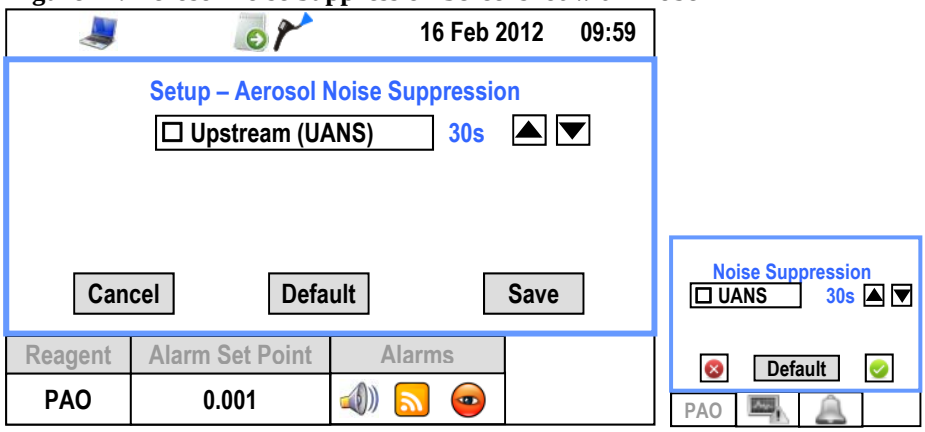



**Table 10: Noise Suppression Options List**

| Parameter | Function | Icon | Limits |
| --- | --- | --- | --- |
| **UANS** | Dampens variations in upstream aerosol measurements | UANS | 30 to 120 s Increments of 10 s |
| **DANS** | Applies an averaging function on the data collected. | DANS | 10 to 30 s Increments of 10 s |

## Reporting Functions

**Figure 23: Reporting Functions Screenshot**

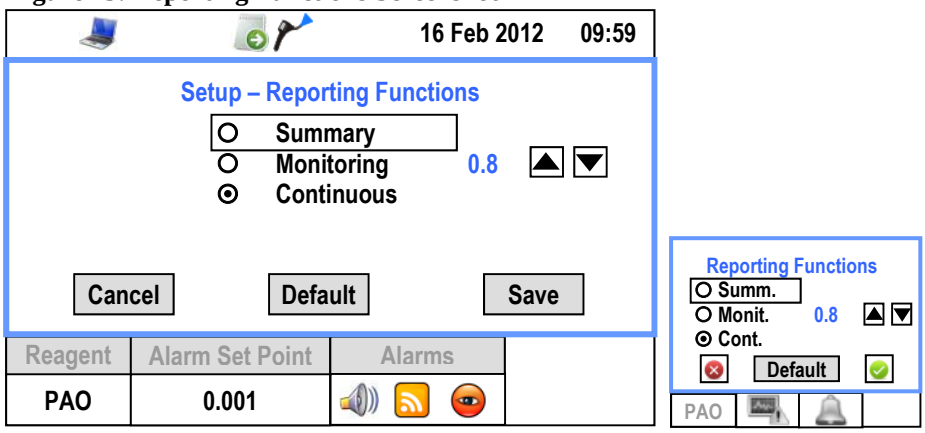
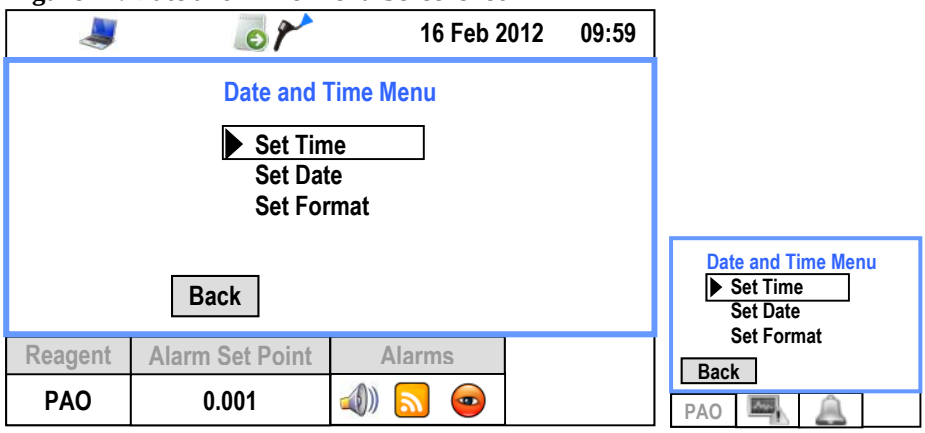



**Table 11: Reporting Mode Options List**

| Parameter | Function | Icon | Limits |
|---|---|---|---|
| **Summary** | Provides a summary of the test to the USB or Printer port. | | N/A |
| **Monitoring** | Provides a summary of the test to the USB port with data sets at user defined intervals. | | Increments of 0.4 s |
| **Continuous** | Provides a % leakage reading to the USB port at approximately a 1 second interval | | N/A |

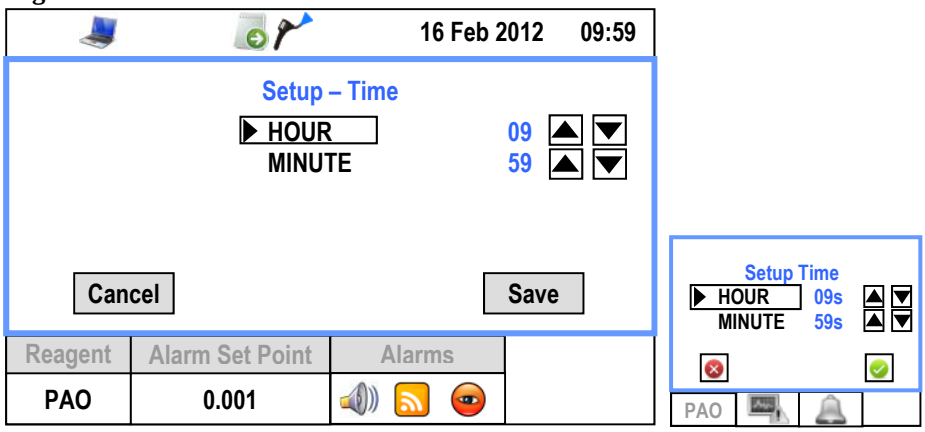
## Date and Time

**Figure 24: Date and Time Menu Screenshot**



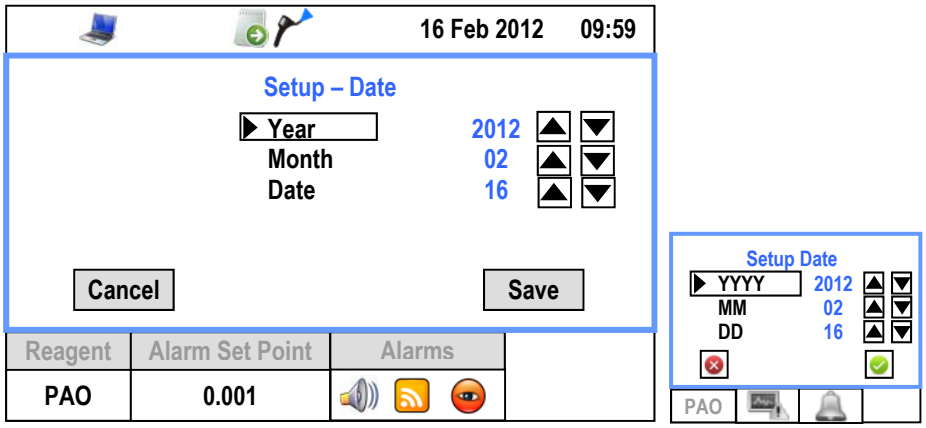

## Set Time

**Figure 25: Set Time Screenshot**




## Set Date

**Figure 26: Set Date Screenshot**

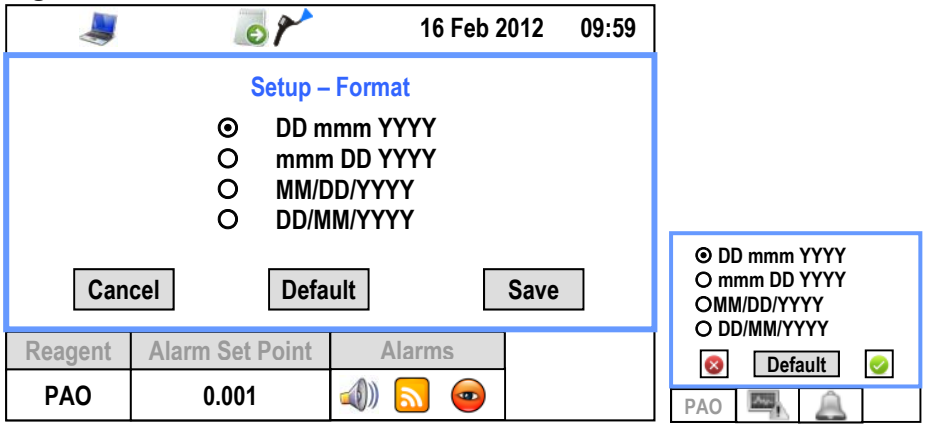



## Note

The 2i will automatically verify the entered date for compliance with leap years. If the date entered does not comply, the entry will be rejected.

### Set Format

**Figure 27: Set Date Format Screenshot**




## Display

**Figure 28: Display Setup Screenshot**

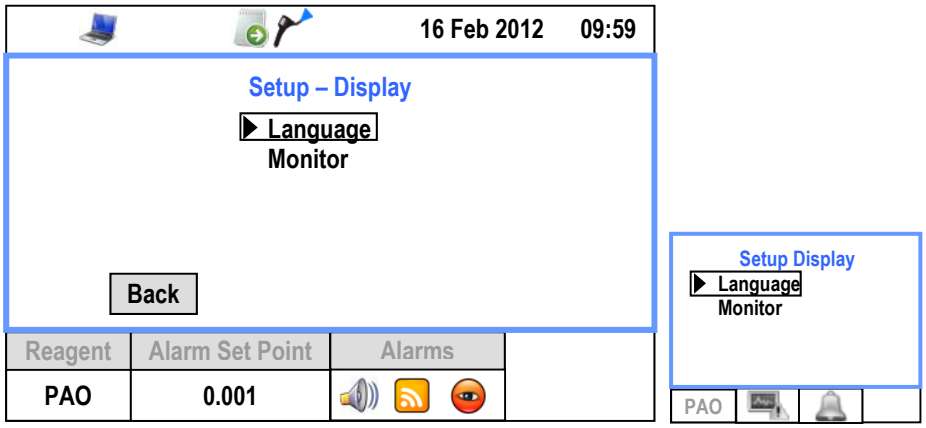



**Table 12: Date and Time Menu Options List**

| Parameter | Function |
|---|---|
| **Language** | Change the default language the unit operates in. |
| **Monitor** | Menu to change the screen setup. |

**Figure 29: Display Setup Screenshot**

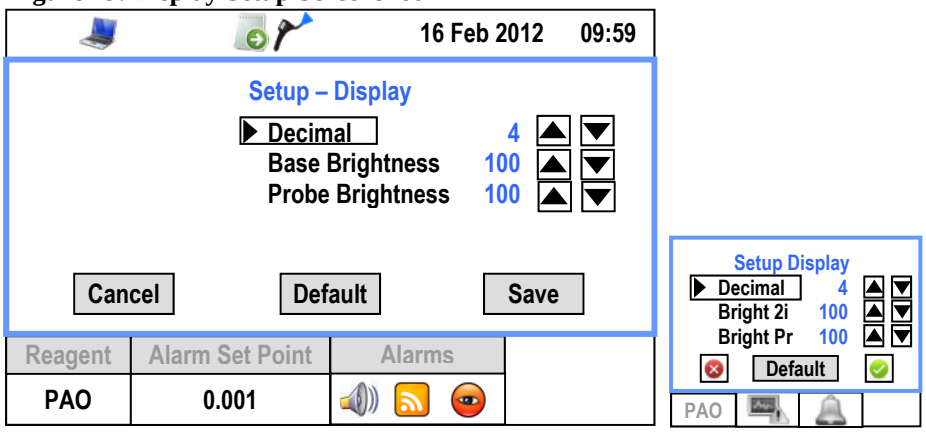


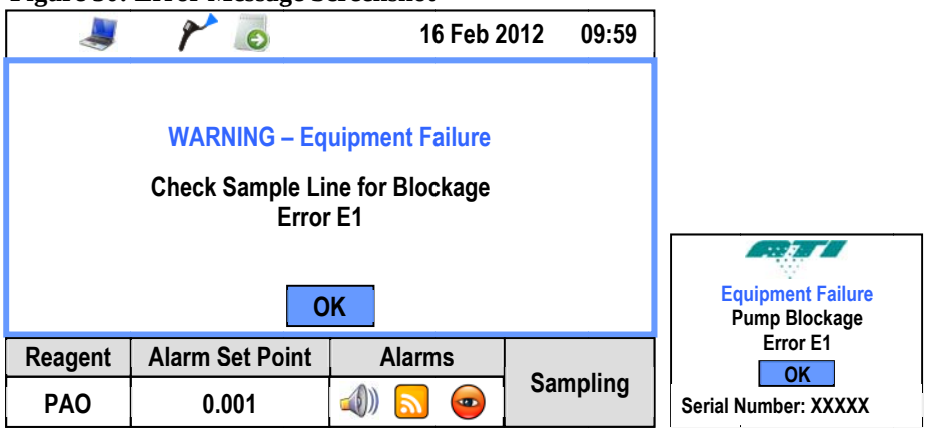

**Table 13: Date and Time Menu Options List**

| Parameter | Function | Limits |
|---|---|---|
| **Decimal** | Displays the % Penetration with three or four decimal places. | 3 or 4 |
| **Base Brightness** | Adjust the base unit screen brightness. | 25, 50, 75, 100 |
| **Probe Brightness** | Adjust the *iProbe* screen brightness. | 25, 50, 75, 100 |

# Error Messages

The 2i has multiple error or abnormal operation checks built into the software.

**Figure 30: Error Message Screenshot**




When an error occurs, the operator is prompted for a course of action. Software generated alarms require the operator acknowledgement to proceed. This is done by pressing the **OK** button.

**Table 14: List of Operator Error Messages**

| Error ID | Reason | Remedy |
|---|---|---|
| E1 | Obstruction in the line. Max Pump flow reached | Refer to troubleshooting guide in appendix |
| E2 | Unit too hot or cold for operation | Refer to troubleshooting guide in appendix |
| E3 | PMT error call ATI | Refer to troubleshooting guide in appendix |

# CHAPTER 7
# Application Notes

## Abbreviations List

**Table 15: Abbreviations List**

| Abbreviation | Meaning |
|---|---|
| g | Grams |
| l | Liter |
| µ | micro ($1x10^{-6}$) |
| m | milli ($1 \times 10^{-3}$) |
| µg/l | micrograms per liter |
| $mg/m^3$ | milligrams per cubic meter |
| lpm | liters per minute |
| STP | standard temperature and pressure |
| LSC | light scattering chamber |

## Aerosol Correction Factors

The values are for use when substitute liquids are used in-place of the liquid specified for the Factory equipment calibration and setup.

Aerosol Correction Factors used in the 2i are specified in the following table:

**Table 16: Aerosol Correction Factors List**

| PAO Substitute Liquid | PAO Internal Reference Setting |
|---|---|
| DOP (DEHP) | 100 |
| PAO (Emery 3004) | 0.73 |
| DOS (DEHS) | 0.96 |
| Mineral Oil | 0.90 |
| User Defined | - |
| Kaydol | 0.92 |
| Polyethylene Glycol (PEG400) | 1.11 |
| Paraffin Oil | 0.89 |
| Corn Oil | 0.88 |
| Ondina | - |
| Finevestan | - |

# CHAPTER 8
# Maintaining the Photometer

## Definitions and Features

The 2i Aerosol Photometer is a sturdy, solid-state electronic instrument designed to hold up under extended field use. The only moving parts are the vacuum pump, the selector valve and the ventilating fan at the rear of the chassis. Field level maintenance is limited to replacement of the fuses and cleaning of the lint screens. Procedures for these operations are contained in this section.

| Note |
| --- |
| The internal electronics are not user serviceable. Any electronic problems must be analyzed and repaired at an authorized service center. |

Intervals are defined as follow:

| | |
| --- | --- |
| Day | 8 hours of operation |
| Week | 40 hours of operation |
| Annual | 2080 hours of operation |

## Recommended Scheduled Maintenance[1]

### Daily

- Clean the aerosol ports screens. These are located in the black circular aerosol port connector on the front panel of the main unit.
- Remove any loose debris from the Scanning Probe and front panel sampling ports.

### Annually

Return the 2i to a factory authorized facility for calibration and cleaning. Please contact the ATI Customer Service Department at (410) 363-9696 for a

[1] Replacement parts are available from ATI. For part numbers, refer to Table 18: Maintenance and Spare Items page 72

return authorization number. A service date will be scheduled for your instrument at that time.

| Note |
| --- |
| A Return Authorization can also be obtained using ATI's website or by sending an e-mail requesting service information to info@atitest.com. A customer service representative will process your information and contact you with a Return Authorization, necessary instructions and information within 48 hours. |

## Replacing the Main Power Fuses

- Disconnect the power cord from the machine and from electrical source.
- Using a small flat blade screwdriver, open the fuse cover and remove the fuse holder from the power inlet module.
- Remove old fuses and install two new fuses with ATI part number according to Table 17: Replacement Fuses for the 2i.
- Replace the fuse holder by gently inserting it back into the power inlet module until the tabs snap back into their original location.
- Close the fuse cover.
- Reconnect the power cord

**Table 17: Replacement Fuses for the 2i**

| | |
| --- | --- |
| For 115 V or 220 V | ATI Part Number 6400001 (5 X 20 mm, 2A, 250V, SLOW BLO) |

## Cleaning the Lint Screens

The aerosol port connectors on the main unit contain a wire screen to prevent fibers and large particles from being drawn into the photometer. If the screens accumulate a significant amount of debris and become partially clogged, it can interfere with the airflow and affect the accuracy of the photometer and may put an unnecessary strain on the vacuum pump.

| Note |
| --- |

It is recommended that all screens be wiped clean with a lint-free cloth before use each day.

If the screens are punctured, replace them immediately. Spare nozzles and replacement scanning probe components can be ordered from ATI (see “APPENDIX E Maintenance and Spare Items” page 72).

# CHAPTER 9
# Troubleshooting Guide

| Note |
| --- |
| If any remedy listed is not effective, contact ATI for repair service. |

| Note – Battery Information |
| --- |
| The battery type used in the 2i Aerosol Photometer is a 3V lithium ion battery type CR2032. |

## Instrument Will Not Power Up

| Probable Cause | Remedy |
| --- | --- |
| Power cable not plugged in | Plug power cable into an appropriate power outlet |
| Fuse blown | Check system fuse(s) |

## Error E1 – Sample Line Blockage

| Probable Cause | Remedy |
| --- | --- |
| Excessive debris in lint screen. | Check lint screen in hose adapter and clean if necessary. |
| An object has been pulled into the line by vacuum pump. | Inspect probe and umbilical for foreign object. Remove object, if possible. |
| Probe nozzle obstructed. | Move the probe to an area free of obstructions that could prevent flow through the instrument. |
| Pressure transducer or thermistor damaged. | Call ATI for service. |

## Error E2 – Out of Temperature Range

| Probable Cause | Remedy |
|---|---|
| Ambient temperature is below 1°C or above 40°C. | Move instrument to temperature in the range. |
| Thermistor damaged. | Call ATI for service. |
| Probe nozzle obstructed. | Move the probe to an area free of obstructions that could prevent flow through the instrument. |

## Error E3 – Photomultiplier Tube (PMT) Inoperable

| Probable Cause | Remedy |
|---|---|
| No voltage to PMT | Call ATI for service. |
| Scattering chamber dirty or contaminated. | Call ATI for service. |

# APPENDIX A
# Contacting ATI

## For Technical Support or Application Questions

If you experience any difficulty setting up the 2i Photometer or have application questions, contact ATI at (410) 363-9696 or via email at info@atitest.com.

## For Customer Service

If the 2i Photometer is not operating properly, or if you are returning the instrument for service, contact ATI Customer Service at (410) 363-9696 or by email at info@atitest.com. Customer Service will need this information when you call:

- The Aerosol Photometer serial number located on the Instrument Identification on the back of the machine (see “Rear Panel General Overview” page 27).
- A purchase order number (unless under warranty)
- A billing address
- A purchasing point of contact
- A technical point of contact
- A shipping address
- The preferred return shipping carrier

Use the original packing material to return the generator to ATI. If you no longer have the original packing material, you can order it from ATI or use sufficient packing material so the generator is not damaged during shipping.

# APPENDIX B
# Warranty

| | |
|---|---|
| **Part Number** | 1800224 / Revision 1 / March 2012 |
| **Address** | Air Techniques International / 11403 Cronridge Drive / Owings Mills, MD 21117 / USA |
| **Phone No.** | (410) 363-9696 |
| **Fax No.** | (410) 363-9695 |
| **E-mail Address** | info@atitest.com |
| **Limitation of Warranty and Liability** | Air Techniques International, hereinafter referred to as ATI, warrants the equipment purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purpose for which it is designed, for a period of (1) one year from the date of shipment. ATI further warrants that the equipment will perform in accordance with the technical specifications accompanying the formal equipment offer.<br><br>ATI will repair or replace any such defective items that may fail within the stated warranty period, PROVIDED:<br>a. That any claim of defect under this warranty is made within thirty (30) days after discovery thereof and that inspection by ATI, if required, indicates the validity of such claim to ATI's satisfaction.<br>b. That the defect is not the result of damage incurred in shipment to or from our factory.<br>c. That the equipment has not been altered in any way whether as to design or use, whether by replacement parts not supplied or approved by ATI, or otherwise.<br>d. That any equipment or accessories furnished but not manufactured by ATI, or not of ATI design, shall be subject only to such adjustments as ATI may obtain from the supplier thereof.<br><br>ATI's obligation under this warranty is limited to the repair or replacement of defective parts with the exception noted above. If the equipment includes a scattering chamber, ATI's warranty does not extend to contamination of the scattering chamber by foreign material.<br><br>At ATI's option, any defective equipment that fails within the warranty period shall be returned to ATI's factory for inspection, properly packed with shipping charges prepaid. No equipment |

| | |
|---|---|
| | shall be returned to ATI without prior issuance of a return authorization by ATI.<br><br>No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by ATI and the foregoing warranty shall constitute the Buyer's sole right and remedy. In no event does ATI assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of ATI products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause. |
| **Service Policy** | Our service policy is designed to give prompt attention to any problems. If you encounter a defective product or discover a malfunction, please call ATI Customer Service to obtain a return authorization at (410) 363-9696. |

# APPENDIX C
# Declaration of Conformity

We:

**AIR TECHNIQUES INTERNATIONAL**
**11403 Cronridge Drive**
**Owings Mills, Maryland 21117-2247**
**USA**

**Tel: (410) 363-9696**
**Fax: (410) 363-9695**
**Website: http://www.atitest.com**

Declare under our sole responsibility that the product,

**2i Photometer**
**Manufactured beginning April, 2012**

is in conformity with the following directives:

| Application of Council Directive(s) | Standard(s) to which Conformity is Declared |
|---|---|
| Electromagnetic Compatibility Directive (2004/108/EC) | EN61326-1:2006<br>EN61000-3-2:2006<br>EN61000-3-3:2006 |
| Low Voltage Directive (2006/95/EC) | EN61010-1:2010 |

Design documentation is maintained at:

**Air Techniques International**
**11403 Cronridge Drive**
**Owings Mills, Maryland 21117-2247**
**USA**

Eric Hanson
President

Date of Issue: 15 April 2012
Place of Issue: Owings Mills,
Air Techniques International
Maryland 21117-2247
USA

# APPENDIX D
# Specifications

## Main Unit Physical Characteristics

| | |
|---|---|
| Dimension (L x W x H) | 15.2 cm (6 in) x 15.2 cm (6 in) x 33 cm (13 in) |
| Weight | 8.6 kg (19 lb) |

## Operational Requirements

| | |
|---|---|
| Power | 115 VAC, 60 Hz, .5 Amps |
| | 220 VAC, 50 Hz, .25 Amps |
| Electrical Fuses | Two Required, 5 x 20 mm, 2A, 250V, SLOW BLO |

## Operating Conditions

| | |
|---|---|
| Ambient Temperature | 10ºC to 35ºC |
| Ambient Humidity | 5% to 95% (non-condensing or icing) |
| Ambient altitude | From 0 to 10,000 ft |
| Storage requirements | -20 to 60º C<br>Less than 95% Relative Humidity non-condensing |

## Aerosol Detection

| | |
|---|---|
| Technique | Near Forward Light Scattering Photometer |
| Dynamic Range | 0.0001 to 120 mg/m3 |
| Sample Flow Rate | Full flow through detection<br>28.3 liters per minute volumetric |

## Data Output Formats

| | |
|---|---|
| USB Port | 9600,8,1,N |
| Thermal Printer | Thermal Paper, 57 mm (2 ¼ in) wide |

## Outputs

| | |
|---|---|
| Display | 10.9 cm (4.3 in) LCD screen |
| Communication | USB Port |

# APPENDIX E
# Maintenance and Spare Items

**Table 18: Maintenance and Spare Items**

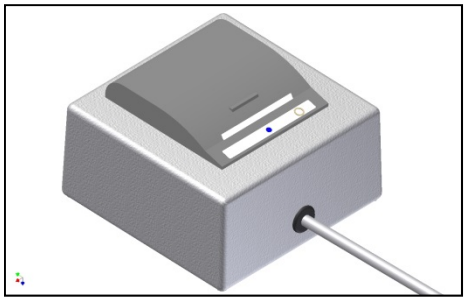
| Part Number | Description | Suggested Quantity |
|---|---|---|
| 0800217 | Scanning Probe Umbilical | 1 ea |
| 5200116 | ¼" ID PVC sample tubing (specify length) | 12 ft |
| 6700001 | Replacement Line Cord, 120V (USA) | 1 ea |
| T2E0-0063 | Replacement Line Cord, 220V (Europe) | 1 ea |
| 6400001 | Fuse, 2 amp, 5 x 20 mm | 2 ea |
| 4300236 | Base Unit Quick-Connect O-ring | 2 ea |
| 1000445 | Lint Screen | 2 ea |
| 2500123 | Thermal Paper (1 roll) | 1 ea |
| 5100001 | Probe - Segment | 3 ea |
| 5100002 | Probe - Male threaded end segment | 1 ea |
| 5100004 | Probe - Female threaded end segment | 1 ea |
| 5100101 | Probe - Male close nipple | 1 ea |
| T2E0-0005 | Probe - NSF 49:1992 nozzle | 1 ea |
| T2E0-0572 | Probe - 1" Isokinetic, round (red) | 1 ea |
| T2E0-0798 | Probe - NSF 49:2002 Isokinetic, rectangular (blue) | 1 ea |

# APPENDIX F
# Accessories

## Scanning Probe

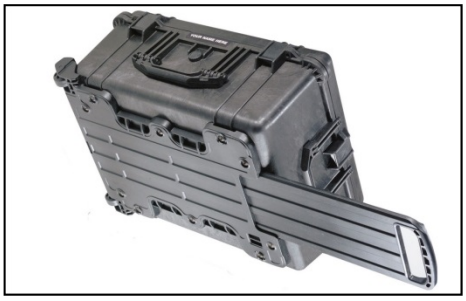
The scanning probe allows the remote operation of the 2i. It allows access to virtually all the functionalities of the base unit from a convenient remote location.

## Thermal Printer Module



The Thermal Printer module is designed to provide certifiers with a mean to maintain test results traceability.

## Transport Case



The rugged Transport Case with its custom foam offers the best protection available for the 2i and its accessories for shipment or daily use.

**Table 19: Accessories List**

| Description | Part Number |
|---|---|
| Scanning Probe | 9300236 |
| Thermal Printer | 0200477 |
| Transport Case | 9300243 |

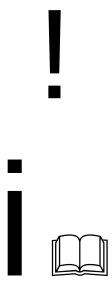
# APPENDIX G
# Manual Revision History

The following is a revision history of the Operation and Maintenance Manual, P/N 1800224

**Table 20: Manual Revision History**

| Revision | Date | Description |
|---|---|---|
| A | 04/24/2012 | |
| B | 5/31/2012 | |
| C | 2/1/2013 | Updated electrical power requirement on page 22, changed ACFM to ALPM on page 33, updated monitoring mode data to show 0.4s increments on page 38, added remark about re-zeroing the instrument after a reagent change on page 51, updated table to show 0.4s increments in monitoring, aerosol correction factors updated on page 60. |
| D | 12/9/2014 | Ondina & Finevestan added to reagent selection menu |
| E | 05/04/2015 | Removal of Printer from Monitoring mode section: Table 11, Page 55. |

# APPENDIX H
# Español – Precauciones



## Advertencia – Reglas Generales de Seguridad

Lea y comprenda todas las instrucciones. La falta de seguimiento de todas las instrucciones listadas abajo podrá ocasionar una descarga eléctrica, fuego o una seria lesión personal. Las advertencias, cautelas y las instrucciones discutidas en este manual de operación y mantenimiento pueden no cubrir todas las posibles condiciones y situaciones que podrían presentarse. El operador debe entender que el sentido común y la cautela son factores que no pueden incorporarse al equipo por lo que deben ser suministrados por el operador.

## Advertencia – Riesgos del transporte

.

## Cautela – Mantenimiento

Cuando reinserte el portafusibles en el módulo de alimentación de energía, verifique que se haya seleccionado el voltaje apropiado para su red eléctrica. El reemplazo incorrecto del fusible puede dañar a los componentes internos del equipo.

## Advertencia – Riesgo Eléctrico

- Riesgo eléctrico que puede ocasionar lesiones severas o la muerte.
- El compartimento eléctrico contiene múltiples fuentes de alto voltaje. No inserte ningún objeto bajo la cubierta.

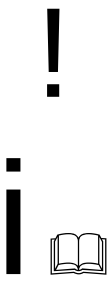
## Advertencia –Equipo Dañado

- No opere el equipo con el cable o el conector dañados o luego de que el equipo ha sufrido un mal funcionamiento o ha sido dañado de cualquier manera.

- Contacte al Departamento de Servicio de ATI para obtener consejos de revisión, de reparación o de ajustes eléctricos o mecánicos.

- La falta en el seguimiento de los procedimientos prescriptos puede producir una situación riesgosa

# APPENDIX I
# Français – Précautions



## Avertissement – Règles générales de sécurité

Lire et comprendre toutes les instructions. Ne pas suivre les instructions listées ci-dessous peut engendrer un choc électrique, un incendie ou des blessures graves. Les mises en garde, avertissements, précautions et instructions détaillées dans ce manuel d'utilisation et de maintenance ne peuvent pas couvrir toutes les situations et conditions pouvant se produire. L'opérateur doit comprendre que le bon sens et la prudence sont des facteurs qui ne peuvent pas être intégré à cet équipement et doivent donc être apportés par l'opérateur.

## Précaution – Risque lié au transport

## Précaution – Maintenance

Le remplacement incorrect des fusibles peut endommager les composants internes de l'appareil.

## Avertissement – Risque électrique

- Les risques électriques peuvent causer des blessures graves, voire mortelles.
- La partie électrique contient plusieurs sources à haut voltage. N'insérez aucun objet sous le couvercle.

## Avertissement - Equipment endommagé

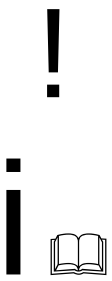
- Ne pas faire fonctionner l'appareil avec un câble d'alimentation ou une prise endommagée ou après que l'équipement ait mal fonctionné ou a été endommagé de

quelque façon.

- Contactez le département Service de chez ATI pour obtenir des conseils sur l'examen, la réparation, l'ajustement électrique ou mécanique

- Ne pas suivre les procédures prescrites peut aboutir à une situation dangereuse.

# APPENDIX J
# 中文 – 预防



## 警告 – 安全规则概要

阅读并理解所有的指导。不按照下面的指导可能会造成被电击，火灾或严重的个人身体伤害。这些警告，小心和在操作和维护说明书中谈到的指导不能涵盖所有的可能发生的危险的条件和环境。但必须理解安全常识和谨慎操作是一个不能建立在机器里的，必须由操作员决定的事情。

## 小心 – 运输危险

## 小心 – 维护保养

不正确的保险丝更换后，可能会损坏内部的自动过滤器测试仪的零件。

## 警告 – 触电

- 触电会引起严重的伤害甚至死。
- 电力供应盒包括多个高压电源，不要塞任何东西在电源供应盒的盖子下面。

!

## 警告 – 损坏的设备

- 当这个设备被损坏，有故障后，或者有一个损坏的电线或插头后不要操作这个设备。
- 联系ATI的服务部门要求给一个建议，怎样检查，维修，电子或机械的调整等。
- 不按照规定的程序可能会造成危险的情形。

# APPENDIX K
# Svenska – Försiktighetsåtgärder

## Varning – Allmänt

Läs och förstå alla instruktioner. Fel i handhavandet kan resultera i elektrisk stöt, brand eller alvarlig personlig skada. Alla varningar som anges i denna instruktion kan inte täcka alla eventuella uppkomna situationer. Det är därför helt avgörande att operatören är medveten om dessa risker

## Varsamhet – Transportrisk

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## Varsamhet – Underhåll

Felaktig säkring kan ge alvarliga skador på filtertestaren.

## Varning- Elektrisitet

- En elektronisk stöt kan innebär alvarlig skada eller död.
- I elektroniken och nätdelen finns högspänning. För aldrig in någonting under skyddskåpan.

## Varning- Skada apparat

- Kör aldrig enheten med skada sladd, kontakt eller vid annan felaktighet på enheten.
- Kontakta alltid ATI för rådgivning vid skada eller vid reparation och justering.
- Att inte följa dessa instruktioner kan medföra stor skada.

## Notes: